4.—A NOTE ON THE OCCURRENCE OF *AMPHIPORA RAMOSA* (PHILLIPS) IN WESTERN AUSTRALIA.

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(Communicated by Professor E. de C. Clarke.)

INTRODUCTION.

A collection of Devonian and Permian fossils from various localities in the Kimberley District, Western Australia, sent by Dr. Arthur Wade, of the Freney Kimberley Oil Company, for examination by Miss D. Hill, of the Sedgwick Museum, Cambridge, contains a number of specimens which may undoubtedly be identified with *Amphipora ramosa* (Phillips), a stromatoporoid occurring abundantly at various horizons within the Devonian of Europe. The Western Australian localities at which this species occurs, and its associates, as far as determined, are as follow:

A397. Northern end of Bugle Gap. No associates.

A412. Mountain Home Spring Valley. Associated with *Prismatophyllum brevilamellatum* Hill.

A422. Near Little Mt. Pierre. Associated with *Disphyllum depressum* (Hinde), *Atrypa aspera* Schlot. and *A. desquamata* Sow.

B89. 1½ miles South of Station K, Rough Range. No associates.

Two other stromatoporoids, *Actinostroma clathratum* Nicholson and *Stachyodes verticillata* (M'Coy) occur at Loc. A251, Palm Spring George, Oscar Range; the associated fauna is not known. The horizon given by Miss Hill from the evidence of the corals occurring at Locs. A412 and A422 is Givetian or Frasnian (Upper part of the Middle or lower part of the Upper Devonian).

Dr. Wade's collection is at present in the Department of Geology, University of Western Australia.

AMPHIPORA SCHULZ.

1883—*Amphipora* Schulz, Jahrb. der Königl. preuss. geol. Landesanstalt (1882), p. 89.

1886—*Amphipora* Nicholson, Mon. Brit. Stromatoporoids, Gen. Introd., p. 109.

Stromatoporoids in which the coenosteum consists of slender, sometimes branching, cylindrical stems, which are usually provided with tabulate axial canals. Skeletal fibre apparently compact; skeletal mesh usually completely reticulate, pillars and laminae not being recognisable as distinct skeletal elements. Astrorhizae absent.

Genotype: *Caunopora ramosa* Phillips. Palaeozoic Fossils of Cornwall, etc., p. 19, pl. VIII., figs. 22a.-c., 1841.

Horizon and localities (of type material): Middle Devonian of Chudleigh and Babbacombe, South Devon.

Amphipora ramosa itself is probably confined to the Devonian, but *A. socialis* Romanowski has been recorded from the Upper Carboniferous of the Timan by Stuckenberg (1895), and a form occurring in the Gotlandian of Turkestan is compared with this species by Riabinin (1928). Another species, described under the name of *A. asiatica* by F. R. C. Reed (1927, p. 180) and considered to be closely allied to *A. socialis* Romanowski, is at present in the Upper Carboniferous of Yun-nan. A form similar to this is described by Yabe and Sugiyama (1933) as occurring in the Permian of Japan. The form occurring in the Glen Bower Series of the Murrumbidgee Beds of Boambalo Crossing, Murrumbidgee River, New South Wales, and described by R. Etheridge, jun. (1917) as *A. australica*, is very similar to, and may even be identical with *A. ramosa* (Phill). The genus *Amphipora* has therefore a comparatively long range in time, being found in various forms, whose limits of variation are rather ill-defined, in Gotlandian, Devonian, Carboniferous and Permian faunas.

Amphipora ramosa (Phillips).

1841—*Caunopora ramosa* Phillips. Palaeozoic Fossils of Cornwall, etc., p. 19, pl. VIII., figs. 22a.-c.

1883—*Amphipora ramosa*; Schulz, Die Eifelkalkmulde von Hillesheim, p. 90, pl. XXII., figs. 5-7; pl. XXIII., fig. 1.

1886—*Amphipora ramosa*; Nicholson, Mon. Brit. Strom., Gen. Introd., p. 109, pl. IX., figs. 1-4.

1892—*Amphipora ramosa*; Nicholson, Mon. Brit. Strom., p. 223, pl. XXIX., figs. 3-7.

1919—*Amphipora ramosa*; Vinassa de Regny, Pal. italica, vol. XXIV., p. 109, pl. IX. (IV.), figs. 14, 15.

1934—*Amphipora ramosa*; Le Maitre, Mém. Soc. Géol. du Nord, XII., p. 202, pl. XVII., figs. 2, 3.

Diagnosis.—Coenosteum built up of cylindrical stems, usually parallel, sometimes branching in a dichotomous manner. Skeletal mesh reticulate; radial pillars sometimes distinct; skeletal fibre apparently compact. Tabulate or non-tabulate axial canals and marginal vesicles may be present.

Description and Remarks.—The specimens from Western Australia are much weathered and show clearly the characteristic fasciculate form of the coenosteum of this species. The stems are from 3 to 5 mm. in diameter, are usually simple, and sometimes have an irregularly roughened exterior, produced by the weathering of the marginal vesicles. Weathered transverse sections frequently show the presence of an axial canal.

Transverse sections show an irregularly reticulate skeletal mesh which makes up the greater part of the stem. Small axial canals, 1mm. or less in diameter, are frequently present. Some specimens, which may also be provided with an axial canal, have well-defined marginal vesicles of greater diameter than the interspaces of the normal skeletal mesh (see Text-figure 2). These two characters are not necessarily connected, however, since many cross-sections show either one or the other, developed to varying extents. Nicholson (1892), in his description of the species, refers to this variation in the appearance of transverse sections, but his material seems to have contained two prominent types of specimens: the first having a large axial canal, dense reticulate tissue and large marginal vesicles, and being enveloped

in an epitheca, and the second having a loosely reticulate structure, with small marginal vesicles, and an imperfect axial canal. Some examples of the second type lacked an axial canal, and all lacked the epitheca. Le Maitre (1934), on the other hand, notes that the epithecate specimens with the large vesicles lack axial canals, and that those having a finer skeletal mesh and no vesicles are provided with axial canals. Both writers agree that these forms are probably different conditions of the same species, and Le Maitre notes that it is impossible to identify as *A. ramosa* (Phill.) only those specimens which show at once the axial canal and the marginal vesicles. No systematic variation like that described by Nicholson and Le Maitre has been observed in the specimens from Western Australia.

The appearance of longitudinal sections varies considerably with their position in the coenosteum. Those passing through the periphery of a branch show an irregularly reticulate skeletal mesh similar to that seen in transverse sections. A section passing through the centre of a branch reveals the axial canal, if present, and shows in some specimens a rather regular skeletal mesh which builds up the larger part of the coenosteum and usually terminates against the zone of marginal vesicles. This central zone of regular structure has well-defined radial pillars which pass obliquely outwards from the neighbourhood of the axial canal (when present), and which are connected by irregular processes. These sometimes occur at similar levels in neighbouring interspaces, but definite laminae are not present. This type of skeletal mesh is very similar to that seen in the longitudinal sections figured by Schulz (1883 pl. XXII., figs. 5, 6), and in those of Le Maitre (1934, pl. XVII., fig. 2). It must be noted, however, that this structure in the Western Australian specimens is not restricted to those which lack an axial canal, but occurs quite independently of the presence or absence of this latter character.

Amphipora ramosa (Phillips) occurs at a number of horizons within the Devonian. The specimens described by Phillips came from Chudleigh and Babbacombe, South Devon; the main mass of the limestone at the latter locality has been referred by Shannon (1928, p. 113) to his C1 horizon (top of the Givetian). Schulz (1883) describes the occurrence of the species in banks, forming a definite horizon (Bänke mit *Amphipora ramosa*) in the upper part of the Middle Devonian of Hillesheim in the Eifel. Nicholson (1892) in describing the British occurrence notes the presence of the species in the Devonian limestones of Shaldon, Newton Abbot, Teignmouth, etc., but as most of the specimens come from the pebbles of the Permian (New Red Sandstone) conglomerate, no evidence of the horizon within the Devonian can be obtained. Vinassa de Regny (1919) has described the species from the Middle Devonian of the Carnic Alps. Later work has extended the geological range of the form: Le Maitre (1934) has described the occurrence of typical specimens in banks in the Chalonnes Limestone of Maine-et-Loire, of Coblenzian-Eifelian (Lower-Middle Devonian) age, and Riabinin (1932) records its occurrence in the Frasnian (Upper Devonian) of the Timan. It is probable that this species ranges at least throughout the Devonian, but has met with conditions favouring the formation of banks only at certain horizons, notably the Coblenzian-Eifelian in the Maine-et-Loire region and the Givetian in the Eifel district. The Western Australian form has apparently formed banks under similar conditions, though the exact horizon at which these conditions prevailed has not yet been determined.

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EXPLANATION OF FIGURES.

Plate 1.

Amphipora ramosa (Phillips). A specimen showing the external form of the coenosteum. Natural size. Loc. A422, near Little Mt. Pierre, Kimberley District, Western Australia.

Text-Figure 1.

Amphipora ramosa (Phill.). Longitudinal section of a specimen possessing an axial canal (a), radial pillars (p) and marginal vesicles (v). x 8. Loc. A412, Mountain Home Spring Valley, Kimberley District, Western Australia.

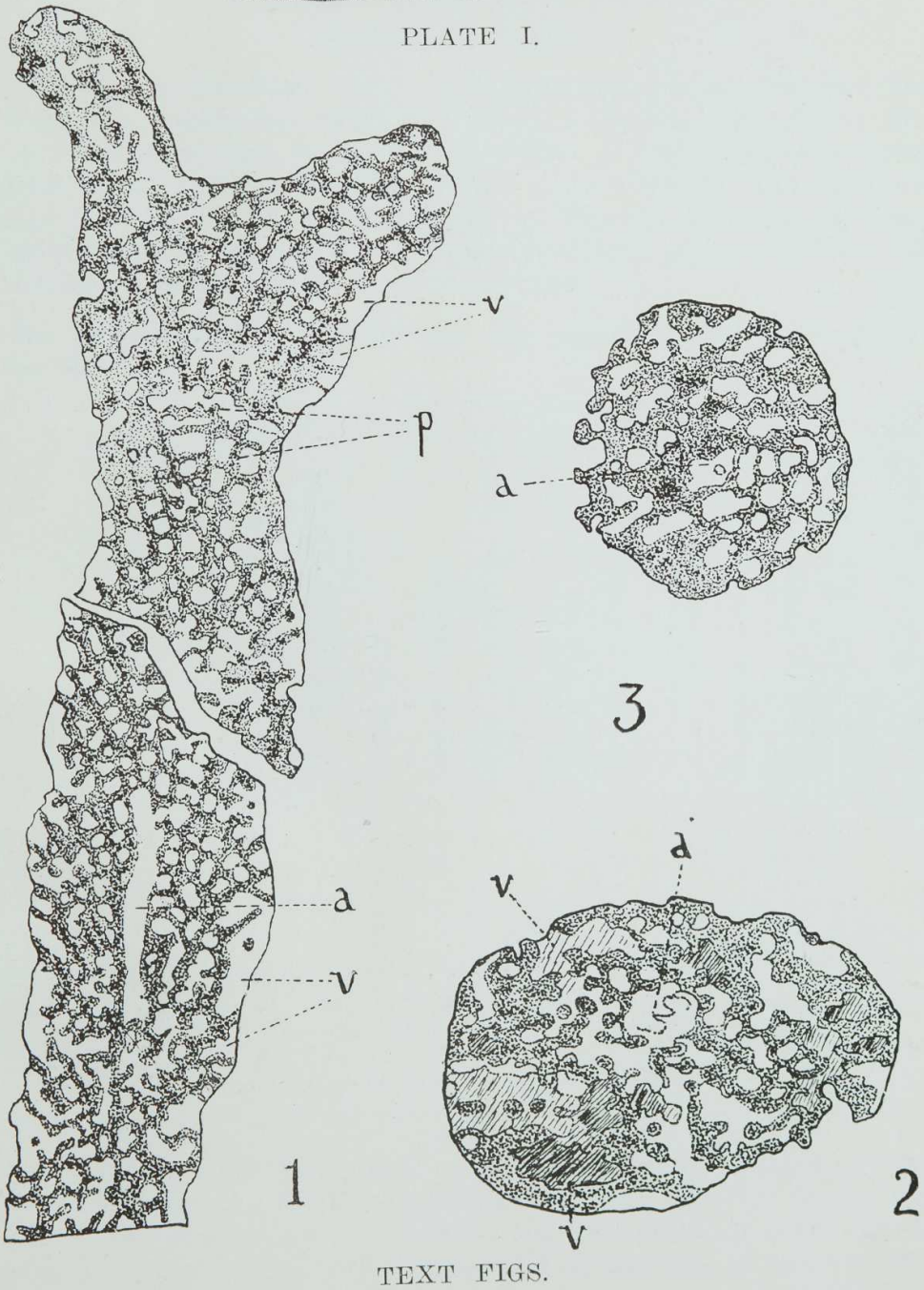
Text-Figure 2.

Amphipora ramosa (Phill.). Transverse section of a specimen possessing an axial canal (a) and large marginal vesicles (v). Those parts of the section shaded diagonally represent cavities within the skeletal mesh which have become filled with a substance darker in colour than the skeletal fibre. x 8. Loc. A422, near Little Mt. Pierre, Kimberley District, Western Australia.

Text-Figure 3.

Amphipora ramosa (Phill.). Transverse section of a specimen possessing an axial canal (a), but lacking large marginal vesicles. x 8. Loc. A422.

PLATE I.



TEXT FIGS.